WEST Search History

DATE: Wednesday, May 21, 2003

Set Name side by side	Query	Hit Count	Set Name result set
DB=USPT,JPAB,EPAB,DWPI,TDBD; PLUR=YES; OP=OR			
L3	l1 and L2	59	L3
L2	@ad<=20000228	18711033	L2
L1	(buffer near3 fullness) with (delet$3 or truncat$3 or round$3 or compres$5)	63	L1

END OF SEARCH HISTORY

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L3: Entry 45 of 59 File: USPT Nov 21, 1989

DOCUMENT-IDENTIFIER: US 4882754 A
TITLE: Data compression system and method with buffer control

Abstract Text (1):
In a digital encoder, truncation is controlled by the fullness of the output rate-smoothing buffer. A signal compression system is shown for processing a stream of fixed length digital sample signals, such as audio signals, which system includes a linear digital compression filter for compression filtering the sample signal stream and generating a stream of compression-filtered signals. The compression-filtered stream is encoded by an encoder which implements a variable word length truncated code. The encoder output is supplied to a buffer for transmission to a communication channel. The encoder is controllably operable in a normal mode and in an out of range (OOR) mode. In the OOR operating mode an OOR code word together with the compression filtered signal is sent to the buffer. Buffer underflow is controlled by operation in the OOR mode when the buffer is empty or near empty. Buffer overflow is controlled by truncating sample signals supplied to the compression filter in response to a measure of buffer fullness when the fullness of the buffer exceeds a predetermined level. The level of truncation increases as buffer fullness increases. With a decrease in buffer fullness, a measure of the rate of change of buffer fullness may be used to accelerate the decrease in truncation for improved audio signal quality. Additionally, a measure of variance of the compression-filtered signal stream may be used in conjunction with control based upon a measure of buffer fullness in the control of truncation for improved audio signal quality.

Application Filing Date (1):
19880609

Brief Summary Text (8):
In accordance with the present invention a servo control is provided that increases truncation of the input to the digital compression filter as the fullness of the transmission buffer increases thereby decreasing the average encoder output bit rate below the bit rate of the channel so as to decrease the transmission buffer fullness. As buffer fullness increases an increasing number of least significant bits of the compression filter input words are truncated to further decrease the average encoder output bit rate. Transmitter buffer overflow is thereby substantially eliminated.

Brief Summary Text (11):
Another modified form of this invention employs truncation control dependent upon fullness of the transmitter buffer, of the type described above, together with an adjustment based upon the rate of change of fullness of the buffer. When the change of fullness decreases, as during an audio release transient, a measure of the change of fullness is used to accelerate the decrease in truncation. When the change of fullness increases, as during an audio attack, no adjustment to truncation in response to the measure of change of fullness is required. However, it will be apparent that the increase in truncation may be accelerated in response to an increase in the measure of change of fullness, if desired. With this truncation scheme, based both on fullness and on change in fullness of the transmitter buffer (and upon the preceding truncation level), the sound of fast articulated pieces, such as piano crescendos processed by the present data compression system is substantially improved over arrangements wherein truncation is based solely upon buffer fullness.

Brief Summary Text (12):

If desired, all three truncation control schemes, based upon transmitter buffer fullness, change in transmitter buffer fullness, and standard deviation of the compression filter output, may be simultaneously employed for buffer control. In all buffer control embodiments of this invention a measure of transmitter buffer fullness is an essential element for controlling truncation and operating mode of the encoder in the prevention of buffer overflow and underflow, respectively.

Drawing Description Text (3):
FIGS. 1 and 2 together show a simplified block diagram of a signal compression system with transmitter buffer control based upon buffer fullness embodying the present invention; a digital transmitter being shown in FIG. 1 and a receiver being shown in FIG. 2;

Drawing Description Text (5):
FIG. 4, is a flow diagram showing computation of truncation from transmitter buffer fullness alone, for use in explaining operation of the FIG. 1 arrangement;

Drawing Description Text (7):
FIG. 6 is a simplified block diagram which is similar to that of FIG. 1 but showing a modified form of transmitter wherein truncation is controlled using measures of transmitter buffer fullness and variance of the digital compression filter output;

Drawing Description Text (9):
FIG. 8 is a flow diagram showing computation of truncation from measurements of truncation, transmitter buffer fullness, change in transmitter buffer fullness and the previous truncation value, for use in explaining operation of a transmitter employing a modified form of truncation and encoding logic unit;

Drawing Description Text (10):
FIG. 9 is a flow diagram showing computation of truncation from measure of buffer fullness, rate of change of buffer fullness, and variance of the output from the digital compression filter;

Detailed Description Text (8):
The output from detector 44 comprises a buffer fullness signal, F, which is supplied to logic unit 24 over line 46, where it is used in the determination of how much truncation, if any, should be employed at truncation unit 22 to avoid buffer overflow, and whether encoder 30 should be operated in the OOR operating mode to avoid buffer underflow. During receiver start up, the transmitter buffer fullness signal also is supplied to formatter 34 over line 48 for transmission to the receiver for use in controlling partial loading of a receiver buffer before receiver decoding operation begins. Receiver buffer control start up operation is described in detail hereinbelow following a description of the receiver shown in FIG. 2.

Detailed Description Text (13):
The division of the range fullness of the transmitter buffer 36 for different truncation levels is illustrated in FIG 3, to which figure reference now is made. It here is assumed that input signals, f.sub.n, to truncation unit 22 are 16 bits in length. For purposes of illustration, a 8192 bit buffer is shown, and the range of fullness is divided into regions that correspond to a truncation level. For example, when the buffer is equal to or less than half full, there is no truncation, i.e. T=O. When 4096<F.ltoreq.4096+256, there is one bit of truncation; when 8192-256<F.ltoreq.8192 the truncation is 16 bits, where F= fullness of the buffer. There will be delay between a change in the bit rate from encoder 30 and a change in truncation level provided by truncation unit 22. The bin widths of 256 bits when the buffer is over half full have proven satisfactory with 16 bit audio and sampling rates of 31,500 to 41,000 samples/sec. and block lengths of up to 128 samples. Changes in truncation usually will be .+-.1.

Detailed Description Text (34):
Although satisfactory transmitter buffer control can be obtained using a measure of fullness, F, alone, listening tests have shown that the quality of some types of music can be improved by incorporating .sigma.(.DELTA..sub.n) into thecontrol. A modified form of transmitter which combines measures of buffer fullness, F, and .sigma.(.DELTA..sub.n) in the servo control is shown in FIG. 6, to which figure

reference now is made. The FIG. 1 and FIG. 6 embodiments include many of the same elements and the description of these elements, which are provided with the same reference numbers, will not be repeated here. The transmitter of FIG. 6 includes a variance calculating unit 1041 responsive to the output, .DELTA..sub.n, from the digital compression filter 28 for determining the variance of blocks of said compression filtered signals. The variance signal, .sigma..sup.2 (.DELTA..sub.n) determined by unit 104 is supplied to a truncation and encoding logic unit 105 along with the buffer fullness signal from detector 44. The truncation unit 22 and encoder 30A are controlled by outputs from logic unit 105 in the same manner described above with reference to FIG. 1.

Detailed Description Text (46):
referece now is made in FIG. 7 wherein a flow diagram for the computation of truncation based upon both transmitter buffer fullness and a measure of variance of the compression filter output, .DELTA..sub.n, is shown, which may be employed in the FIG. 6 embodiment of the invention. After start step 106, decision step 108 is entered where it is determined if the fullness, F, of transmitter buffer 36 is greater than one-half the buffer size. If the buffer is less than one half full, decision step 108 is negative and step 110 is entered where the truncation is set to zero. End step 114 then is entered.

Detailed Description Text (49):
The value of truncation, T, calculated at step 122 is the sum of weighted values, K.sub.3 i +K.sub.1 F, rounded of to an integer, where K.sub.3 and K.sub.1 are weight constants, i is the value of the integer employed in decision step 118 which is dependent upon a meausure of variance, and F is transmitter buffer fullness.

Detailed Description Text (52):
Computation of Truncation from Transmitter Buffer Fullness, F, Change in Transmitter Buffer Fullness, F, and Previous Truncation

Detailed Description Text (53):
As noted above, there is a noticeable potential degradation in the reproduction of audio transients (attackes and releases) when the truncation level is controlled solely by the transmitter buffer fullness. By using a measure of variance of the compression filter output, together with separate time constants for truncation control during attacks and releases, as described above, substantial improvement is provided. In another modified form of this invention use is made of buffer fullness and changes in transmitter buffer fullness for control of truncation, which also results in noticeable improvement in signal reproduction of audio transients over that obtained using a control based solely on buffer fullness.

Detailed Description Text (54):
With this embodiment, two separate control schemes T.sub.A and T.sub.B may be envisioned wherein T.sub.A is a scheme based solely on buffer fullness, and is the more heavily weighted scheme when the buffer is full. T.sub.B is an adjustment scheme based on the presence of attacks or releases, and is applied when the transmitter buffer is at low levels of fullness. A block diagram of a transmitter employing this modified form of transmitter buffer control is the same as that shown in FIG. 1 and described above. However, operation of truncation and encoding logic unit 24 differs from that of FIG. 1 to not only make use of buffer fullness measurements supplied thereto from buffer fullness detector 44, but also to employ changes in buffer fullness which occur from block to block, and to use the prior truncation setting. The changes in buffer fullness values are readily calculated at logic unit 24 from the buffer fullness values supplied thereto. Consequently, no separate block diagram drawing is required for use in explaining operation of this embodiment of the invention.

Detailed Description Text (56):
The T.sub.B adjustment is: ##EQU10## where F is the difference in fullness in the buffer (bits in- bits out) arising from processing the latest block, T.sub.old is the truncation employed when transmitting the previous block, the sgn () function, "signum", represents the sign of F, and N.sub.b is the number of samples in a block of data. C is a gain coefficient which amplifies the impact of the attack/release adjustment. It will be seen that the adjustment formula "recommends" no increase in

truncation from the present value (T.sub.old) during an attack, since 1-sgn F equals zero when transmitter buffer fullness increases. With a decrease in buffer fullness. 1-sngF equals 2, and since F-N.sub.b is a negative value when F decreases during a release, a decrease in truncation by a factor of 2C levels is recommended during a release. In a practical arrangement wherein C=1, a reduction in truncation by two is "recommended" if F averaged one bit per sample below the nominal channel rate.

Detailed Description Text (57):
As noted above, the T.sub.A truncation control scheme is more heavily weighted when the buffer is full, and the T.sub.B scheme is more heavily weighted as the buffer fullness decreases. The resulting adaptive truncation is: ##EQU11##

Detailed Description Text (59):
A flow chart showing computation of truncation, T, from buffer fullness, F, rate of change of fullness, F, and previous truncation, T.sub.1, is shown in FIG. 8, to which figure reference now is made. From start step 140, computation step 142 is entered wherein the change in fullness, F, of the transmitter buffer is calculated by subtraction of the previous fullness, F.sub.1 from the present fullness. Next, decision step 144 is entered where it is determined if the change in fullness is greater than zero. If the decision is affirmative, indicating that the buffer is filling, step 146 is entered wherein a value K is set to zero. The value K is employed in the calculation of truncation performed in step 150 in a manner described below. If, on the other hand, the change in buffer fullness, F, is less than zero indicating that the buffer is emptying, then decision step 148 is entered where a value of K is calculated using the equation K=2F/N.sub.b where, as noted above N.sub.b is the number of samples in a block of data. The equation, K=2F/N.sub.b is derived from Equation (14) for the conditions that sgn F is negative and that C equals 1. Since the equation is only employed when F is negative, K always comprises a negative value when the equation is used.

Detailed Description Text (66):
In Equation (17) the component ##EQU13## based upon the buffer fullness, is weighted by the factor F/B. The other component, T.sub.1 +K, based upon the previous truncation level and the amount of decrease in buffer fullness, is weighted by the factor 1--(F/B). At low levels of buffer fullness the T.sub.1 +K component is most heavily weighted for a most rapid decrease in truncation level. End step 152 is entered from truncation computation step 150. As with other arrangements, a new truncation level is computed for each block of sample signals transmitted. As described above, the truncation and encoder control logic unit also functions to place encoder 30 in the OOR operating mode whenever the transmitter buffer fullness decreases below a predetermined level of, say, 256 bits. For simplicity, this operation is not included in the flow diagram of FIG. 8.

Detailed Description Text (68):
If desired, the truncation employed may be based upon measures of transmitter buffer fullness, change in fullness, and variance of the output from compression filter 28. A flow diagram showing this type of operation is shown in FIG. 9, to which figure reference now is made. It will be seen that the diagram of FIG. 9 includes some of the same steps as employed in the flow diagram of FIG. 7, and, therefore, the same reference characters are used for steps in FIG. 9 which correspond to steps employed in FIG. 7. Following start step 156, step 108 is entered where it is determined if the transmitter buffer fullness, F, exceeds one half the buffer size and, if the buffer is one half full, or less, the truncation level is set to zero at step 110 whereupon end step 114 is entered. If the transmitter buffer is greater than one half full, then .sigma..sup.2 (.DELTA..sub.n) is calculated at step 116, and i is set to zero. The value of i to be used in calculating truncation based upon variance is calculated using steps 118 and 120.

CLAIMS:

2. A signal compression system as defined in claim 1 wherein said truncating means is operable to truncate digital sample signals only when the fullness of said buffer exceeds a predetermined level.

7. A signal compression system as defined in claim 1 including means for obtaining a

measure of the change in fullness of said buffer, and

wherein said means for controlling the truncating means is responsive both to said measure of fullness and measure of change in fullness to substantially prevent overflow of said buffer means.

9. A signal compression system as defined in claim 7 wherein the response of said truncation controlling means to said measure of change of buffer fullness increases with decreasing buffer fullness.

10. A signal compression system as defined in claim 7 wherein the response of said truncation controlling means to said measure of fullness decreases with decreasing buffer fullness and

the response of said truncation controlling means to said measure of change of buffer fullness increases with decreasing buffer fullness.

11. A signal compression system as defined in claim 7 wherein said means for controlling the truncating means is responsive to said measure of change of fullness only with a decrease in buffer fullness.

12. A signal compression system as defined in claim 11 wherein the response of said trucation controlling means to said measure of change of buffer fullness increases with decreasing buffer fullness.

13. A signal compression system as defined in claim 11 wherein the response of said truncation controlling means to said measure of fullness decreases with decreasing buffer fullness, and

the response of said truncation controlling means to said measure of change of buffer fullness increases with decreasing buffere fullness.

15. In a signal compression system for preparing a digital sample signal stream of equal word length sample signals for transmission, or the like,

linear digital compression filter means for compression filtering the digital sample signal stream and generating a stream of equal word length compression-filtered signals,

digital encoding means for encoding the compression-filtered signal stream by use of a variable word length code,

buffer means into which the encoder signal stream is written and from which bits are removed, and

means for controlling the average bit rate from the encoding means to substantially prevent overflow of said buffer means, said controlling means including means for controlling truncation of the digital sample signal in response to a measure of fullness of said buffer means.

17. In a signal compression system as defined in claim 16 wherein said means for controlling truncation also is responsive to a measure of change in fullness of said buffer means.

18. In a signal compression system as defined in claim 17 wherein said means for controlling truncation in response to a measure of change in fullness of said buffer means is responsive to changes produced by a decrease in buffer fullness and is non-responsive to changes produced by an increase in buffer fullness.

21. In a signal compression system as defined in claim 20 wherein said means for controlling truncation also is responsive to a measure of change in fullness of said buffer means, decrease in truncation being accelerated in response to said measure of change in fullness with a decrease in fullness of said buffere means.

27. In a signal compression method for preparing a digital sample signal stream of

equal word length sample signals for transmission at a substantially constant bit rate, which method includes linear digital compression filtering said sample signal stream for generating a stream of compression-filtered signals, digital encoding the compression-filtered signals to generate a stream of variable word length encoded compression-filtered signals, passing the encoded signal stream to a transmission channel through buffer means, the improvement including,

truncating the sample signals before compression filtering thereof in an amount dependent upon a measure of fullness of said buffer means to substantially avoid overflow of said buffer means, truncation being increased and decreased in response to increased and decreased buffer fullness, respectively.

28. In a signal compression method as defined in claim 27 including accelerating a decrease in truncation in response to a measure of change in fullness of said buffer means with a decrease in buffer fullness.

29. In a signal compression method as defined in claim 28 wherein truncation is unaffected in response to the measure of change in fullness of said buffer means with an increase in buffer fullness.

L3: Entry 32 of 59 File: USPT Nov 8, 1994

DOCUMENT-IDENTIFIER: US 5363141 A
TITLE: Method and apparatus for transmitting encoded blocks of video signals at different channel rates

Application Filing Date (1):
19930129

Detailed Description Text (22):
The coded modulation scheme outputs, on leads 141 and 146, are applied to multiplexer (mux) 150, which is responsive to buffer control 170, via lead 172, to provide a sequence of symbols to modulator 160. The latter is representative of conventional modulation circuitry for transmission of the broadcast video signal on broadcast channel 200. In a system in which video information is compressed, buffer control 170 monitors the fullness of the buffer and controls the number of bits produced by video encoder 110 based on its buffer fullness determination. If the buffer is too full, the number of bits transferred per data block is decreased, thereby increasing the coarseness of the image being transmitted. If the buffer is relatively empty the number of bits per data block can be increased, thereby decreasing the coarseness of the image being transmitted.

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L3: Entry 20 of 59 File: USPT May 12, 1998

DOCUMENT-IDENTIFIER: US 5751368 A
TITLE: Delay detector apparatus and method for multiple video sources

Application Filing Date (1):
19960517

Detailed Description Text (32):
One example of such applications is in the compression of audio and video signals by JPEG or MPEG compression circuits where as the audio or video signal becomes more complex, the compression takes longer to calculate, causing the filling of a FIFO or other type buffers. It is desired to prevent overflow of the buffer by detecting its degree of fullness, which may be measured by the present delay measurement invention, and adjusting the compression parameters to speed the compression thereby reducing or eliminating the filling of the buffer. The opposite may be detected and compensated when the buffer empties. This application will find considerable interest in the compression and combination of multiple programs which are stored on or transmitted over a limited bandwidth apparatus or channel, such as a satellite transponder. It is desired to keep the total compressed data stream out of the FIFO or buffer just below the transponder data capacity. Consequently the fullness of the buffer needs to be monitored to make sure it neither overflows or underflows.

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L3: Entry 29 of 59 File: USPT Sep 12, 1995

DOCUMENT-IDENTIFIER: US 5450132 A
TITLE: Method and apparatus for data compression with reduced distortion

Application Filing Date (1):
19940111

Detailed Description Text (38):
The buffer 38 has a selected capacity C. A buffer fullness circuit 40 responsive to the state of the buffer 38 produces a fullness signal F indicative of the buffer condition. A limit set circuit 42 responsive to the buffer fullness condition produces a truncation adjustment signal T for the limit circuit 36 so that its output is limited to the most significant residual distortion d.sub.rs.

Detailed Description Text (41):
The buffer capacity C is sufficient to allow the encoder/transmitter 12 to transmit data over the channel 16 at a constant data rate. The buffer fullness circuit 40 and truncation adjustment circuit 42 provide negative feedback to limit set circuit 36 so that as the capacity C of buffer 38 is approached, data to the buffer 32 is reduced and vice versa. Further, because the most significant portion of the residual distortion is encoded, an effective mechanism for error compensation results. The most significant residual distortion d.sub.rs, although truncated or limited, when losslessly compressed or encoded as d.sub.lr is useful in correcting or compensating for the most perceptible distortion in the reassembled signal.

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L3: Entry 31 of 59 File: USPT Nov 15, 1994

DOCUMENT-IDENTIFIER: US 5365552 A
TITLE: Buffer fullness indicator

Application Filing Date (1):
19921116

Detailed Description Text (21):
Referring now to FIG. 3, there is shown graphical representation 50 of the fullness of decoder buffer 18 within receiver buffer 18 of buffer fullness indicator 10 of the present invention. Graphical representation 50 indicates the buffer fullness level of decoder buffer 18 after a conventional editing process is used to delete unit 1 through unit 10 of graphical representation 30. After units 1 through 10 are deleted waveform portion 36 is joined to waveform portion 31 at time t.sub.1.

Detailed Description Text (22):
In graphical representation 50 waveform portion 36 is shifted upward prior to being joined to waveform portion 31. This must be done in order to bring the buffer fullness at the beginning of waveform portion 36 from it previous level, buffer fullness level 34, to the level of buffer fullness level 32. As previously described, buffer fullness level 32 is the fullness of receiver buffer 18 where deletion of unit 1 began at the end of waveform portion 31. As shown, in graphical representation 50 waveform portion 36 is shifted forward in time in order for waveform portions 31, 36 to be joined at time t.sub.1. It will be understood by those skilled in the art that the beginning of waveform portion 36 and the end of waveform portion 31 must be at the same time and the same level within the calculations of buffer model 26.